PROFILE OF THE YOUTH SELF-REPORT AMONG SOUTH TEXAS ADOLESCENTS AND THE POTENTIAL RELATIONSHIP TO PESTICIDE EXPOSURE

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Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

August 1999

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Hagar, Kristy S., Profile of the youth self-report among south Texas adolescents and the potential relationship to pesticide exposure. Doctor of Philosophy (Psychology), August, 1999, 44 pp., 5 tables, references, 75 titles.

The potential for human exposure to pesticides exists particularly for agricultural workers (i.e. migrant workers) and individuals within close proximity to pesticide-sprayed crops (i.e. those living on or near agricultural farms). Children, through biology and behavior, may be more susceptible and vulnerable to exposure to pesticides than adults. The purpose of this study was to examine young populations particularly at-risk for occupational or accidental exposure to pesticides and determine associated behavioral, emotional, and physical symptoms. A total of 444 students from two South Texas school districts completed questionnaires assessing level of risk of exposure to pesticides and were categorized into at-risk and low risk categories. Physical, emotional, and behavioral symptoms were obtained using the Youth Self-Report. Children who were at-risk demonstrated significantly higher scores on the Youth Self-Report (YSR) in the areas of anxious/depressed, attention problems, social problems, somatic complaints, thought problems, withdrawal, internalizing behaviors, and total problem behaviors than children who were at lower risk of pesticide exposure. Odds ratios were obtained and suggested that children in the at-risk category were more five times more likely to score in the clinically significant range on the Attention Problems subscale, and three times more likely to score in the clinically significant range on the Internalizing behavior composite. These findings suggest that children who may be at higher risk for pesticide exposure may also be at higher risk for physical, behavioral, and emotional problems compared to children who are at lower risk. This information is intended to benefit schools and health care professionals who work with rural or migrant populations

involved in the agricultural trade. Future research will be needed to assess through biomarkers the degree of measurable pesticide exposure in comparison to parent reports, teacher reports, school achievement, neuropsychological testing, and medical records.

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According to Dumont (1989), the soil, water, and air have become dangerously polluted. Although the effect of naturally-existing toxins such as lead and mercury have been well known for decades, the deleterious effect of mass-produced chemicals such as pesticides has only recently been addressed (Dumont, 1989). During the last half-century, there has been a 350-fold increase in the production of chemicals, resulting in millions of mixtures currently available for commercial use (Dumont, 1989). Development of pesticides for commercial use began in the mid- nineteenth century (Reigart, 1995) as interest increased in their use for crop protection (Hassall, 1982). Initial use of arsenic-based compounds gave way in the 20th century to synthetic developments in pesticide control (Reigart, 1995). By the 1950's, 90% of all agricultural pesticides were synthetic (Reigart, 1995). The use of pesticides today has continued to be an important and beneficial factor in human health and agriculture. Pesticides protect valuable crops and allow the growing of high quality and substantial food products for human consumption (Texas Department of Agriculture, 1984). Human benefits have been seen as well. According to Hassall (1982) the pesticide DDT saved many lives due to it's success in controlling the vectors carrying diseases such as malaria and yellow fever.

Mechanisms of Exposure

Humans can be exposed to pesticides primarily by absorption through the skin, although inhalation and oral ingestion can occur (Moses, 1989). Pesticides have been noted to most often exert their toxic effects in two ways (Moses, 1989). Chronic low-level exposure occurs when an organism is exposed repeatedly to small, non-lethal doses of a potentially harmful substance, while an acute exposure is usually related to a severe, single-dose exposure to the toxin (Hassall, 1982). A measure of acute toxicity, "LD50", is the amount of poison that will kill half the organisms (usually rats) in an experimental setting. LD50 ratings are broken down into three levels of toxicity: 1 to 50 mg per kg body weight (mg/kg) is considered highly toxic, 50 to 500 mg/kg is moderately toxic, and 500 to 5000 mg/kg is considered mildly or slightly toxic (Hassall, 1982).

In 1991, an estimated 817 million pounds of pesticides were used in agricultural settings (Reigart, 1995). Pesticide poisoning has been identified as a major health problem, particularly in Third World countries (Chivian, McCally, Hu, & Haines, 1993). It's estimated that there are three million severe, acute poisonings each year, and almost 220,000 deaths attributed to pesticide exposure (McConnell & Hruska, 1993). Hartman (1995) reported that at least 600 pesticide ingredients are cataloged by the EPA, and a large percentage of these chemicals are neurotoxic.

Most pesticides used today are divided into five classes: insecticides, fungicides, herbicides, and nematocides, and rodentcides (Reigart, 1995). The majority of pesticides used in agriculture have generally been insecticides of three chemical classes: organophosphates, carbamates, and organochlorines (Hassall, 1982).

The organochlorine (OC) compounds such as dichlorodiphenyltrichloroethane (DDT), kepone, and chlordane are used for specific purposes rather than as an all-purpose insecticide due to their chemical stability in the environment and their indiscriminate killing of both beneficial and target insects (Hassall, 1982). During the second World War, DDT was developed and organophosphate compounds were being produced. DDT was widely used in the 1940's through the 1960's because of it's efficient destruction of disease-carrying and crop-damaging insects but it's apparent low acute toxicity to humans (Grolier, 1993; Reigart, 1995). When it was discovered that DDT was highly toxic to the environment and accumulated in the tissues of humans and animals, it was banned for use in the United States in 1972 (Grolier, 1993). The presence of DDT has been identified decades after it was banned in human tissue and breast milk (Reigart, 1995; Rogan, 1996) and in a home tested for pesticides (Lewis, Fortmann, & Camann,1994), reflecting evidence of it's persistence in the environment. The general effect of the OC compounds are to destabilize electrical neural activity, which manifests in a hyper-excitability of the nerves and the muscles (Hassall, 1982). The resulting symptoms of OC poisoning can include headache, dizziness, irritability, tremor, and confusion (Hartman, 1995). Other symptoms include hyperactive reflexes, muscle twitching, and ataxia (Singer 1990). Singer (1990) also indicated that chronic exposure to OC compounds result in anxiety, irritability, insomnia, and motor pathology. White, Feldman, & Travers (1990) reported the case of a family exposed to chlordane, an organochlorine pesticide. The family was exposed in their home after it was treated for termite infestation. Two of the three children (ages 8 and 11) living in the home were tested by the school district prior to their pesticide exposure. Therefore, pre-exposure testing was available to compare to post-exposure testing. Both children exhibited significant decreases in test scores on the Similarities, Vocabulary, and Block Design subtests on the WISC-R. All three children exhibited attentional deficits, but the authors noted that the reliability of those behavioral symptoms were unclear and may have been present before the chlordane exposure. The two adults who were tested exhibited short-term memory deficits and moderate visual organizational difficulties. Complaints of fatigue, anger, and clinical depression were also reported by both of the adults. The LD50 of DDT is 250 mg/kg (Hassall, 1982). The acute LD50 of chlordane ranges from 250 to 590 mg/kg (Singer, 1990).

DDT was replaced to a large degree by the organophosphates and carbamate pesticides (Mearns, Dunn, & Lees-Haley, 1994). The organophosphate and carbamate compounds were also beneficial to human health, sufficiently controlling the vectors for various human parasitic diseases such as dengue and filariasis (Hassall, 1982). Both the organophosphate (OP) and carbamate pesticides have increased in use since the early 1970’s, when organochlorines such as DDT were banned (Mearns et al., 1994).

Organophosphates were discovered as potential insecticides during their production and study in Germany during World War II as chemical warfare nerve gas agents (Hassall, 1982).The OP compounds are the most common pesticides used today, and have been preferred over the organochlorines because they typically are less persistent in the environment (Hassall, 1982). The OP compounds can vary greatly in their toxicity. Parathion is extremely toxic, with the oral LD50 to rats only 3-10mg/kg. Malathion, another commonly used OP compound, is much less toxic, with an oral LD50 of approximately 1400 mg/kg. Organophosphates have accounted for more acute poisonings than any other pesticide group (Mearns et al., 1994). Carbamates are another class of frequently used insecticides. Carbamates are typically employed when the OP compounds do not appear to be as effective (Hassall, 1982).

Organophosphate and certain carbamate pesticides have been determined to be particularly life-threatening to humans and animals because both act by inhibiting acetylcholinesterase, inactivating the neurotransmitter acetylcholine (Little, 1995; Miller, 1982), with subsequent hyperstimulation of the parasympathetic nervous system (Hartman, 1995). Acute intoxication results in symptoms such as salivation, lacrimation, trouble breathing, weakness, tachycardia, and hypertension (Singer, 1990). Mearns et al. (1994) reported that mild intoxication of OP compounds can result in nausea, vomiting, abdominal pain, numbness in the extremities, fatigue, and headaches. Chronic organophosphate poisoning can result in decline of memory, disturbed sleep, loss of appetite, and disorientation (Singer, 1990). Death can also occur, usually due to suffocation through weakened respiratory muscles, inhibition of the respiratory centers in the brain, or increases in the amount of bronchial secretions (Mearns et al., 1994). Hartman (1995) compared the effect of cholinesterase-inhibiting pesticides to the wealth of information in the psychiatric literature involving anticholinergic drugs. He reported that delirium, agitation, and a "toxic psychosis that mimics dementia" can be caused by anticholinergic drugs. Neuroleptic medications, which also have anticholinergic effects, may cause memory deficits (Hartman, 1995). Levin and Rodnitzky (1976) reported that agricultural and industrial workers chronically exposed to organophosphate pesticides reported symptoms such as "mental confusion", difficulty in thinking, memory deficits, expressive language deficits, and impairment in vigilance and concentration. Psychological symptoms such as anxiety, depression, irritability, and restlessness have also been reported as a result of OP poisoning (Mearns et al., 1994). Goldman (1995) described a case study of diazinon (an OP compound) poisoning in an infant. At a routine examination at 12 weeks of age, the child was noted to have excessive muscle tone in her legs, which progressed to her arms and hands. She was suspected of having mild cerebral palsy and was prescribed physical therapy. Several months later, the parents informed the pediatrician that their home had been sprayed with diazinon by a non-licensed applicator prior to the child's becoming ill. The worker had inappropriately applied the diazinon to total areas of certain rooms, including carpeting and furniture. Following advice to leave the home, the infant recovered.

Herbicides are another frequently used class of pesticides (Moses, 1989). Herbicides gained notoriety as neurotoxic substances due the the controversy and litigation surrounding Agent Orange and the exposure to veterans (Singer, 1990). Hartman (1995) reported that herbicides are typically more toxic to plants than to humans and other animals, but they may contain neurotoxic compounds. One of the most highly toxic and frequently used herbicide is Paraquat (Moses, 1989). According to Hassall (1982), Paraquat has an LD50 of 112 mg/kg but is rarely used in crop situations. Acute exposure to Paraquat can cause injury to the eyes, nose, skin, and throat (Moses, 1989). Death can occur from asphyxiation due to pulmonary fibrosis (Moses, 1989).

Other pesticides used on a smaller scale, particularly in agricultural use, are pyrethroids and organometallic compounds. Pyrethroids are available as natural and synthetic compounds derived from the Chrysanthemum flower (Hassall, 1982). Pyrethroids have shown selective toxicity to the CNS by interfering with permeability of the cell membrane, resulting in loss of coordination and paralysis (Hartman, 1995). The organometallic compounds such as copper, mercury, manganese, arsenic, and zinc have been typically employed in agriculture as fungicides (Hassall, 1982). The heavy metal properties of these compounds can be potentially damaging to humans. For example, a mass poisoning occurred in Iraq in 1971-1972 when the government imported large quantities of grain treated with a methylmercury fungicide. A massive poisoning followed, with the loss of approximately 5,000 lives and many neurologically compromised adults, children, and infants (Weiss, 1983). Psychomotor retardation was noted as the prevalent neurologic symptom in children (Grandjean, Weihe, & Nielsen, 1994).

In addition to neurobehavioral and neuropsychological effects of pesticides, several studies have addressed the possible carcinogenic and immunotoxic properties of pesticides. Shapiro et al. (1995) investigated the incidence of Wilm’s tumor in Brazilian children of workers who were exposed to pesticides. The authors found a significant association between parental farm work involving 10 or more pesticide exposures and risk of developing Wilm’s tumor in their offspring. They indicated that pesticides can be transferred to the children from parental work clothes, through breast milk or in utero from exposed mothers, in foods, in the home, or from the surrounding environment.

A similar study in Norway sought to determine the presence of childhood cancers among families engaged in agriculture. Kristensen, Andersen, Irgens, Bye, & Sundheim (1996) investigated the incidence of cancer among children born between 1952 and 1991 who were born to agricultural or farm-holding families. They discovered that children ages 0 to 14 had a doubled risk for brain tumors and a more than tripled risk for neuroepithelial tumors in association with pesticide purchase. Wilm’s tumor was related to living on a farm with orchards, greenhouses, and pesticide spraying equipment.

Another study involving cancer and pesticides was conducted by Leiss and Savitz (1995). The authors conducted interviews with 252 parents of children diagnosed with cancer (ages 0 to 14 years) from January 1976 to December 1983 in the Denver, Colorado area. The results indicated that elevated exposure to home extermination was found for brain tumors and lymphoma patients. A strong association with yard treatments was observed for soft tissue sarcoma patients. Pest strips showed the most consistent evidence of an association with childhood cancer, especially leukemia. The authors conceded a weakness in their study was the crudeness of the exposure measures and possible recall bias of the participants. However, with those limitations in mind, they concluded that some types of home pesticide use may be associated with childhood cancers.

Vial, Nicolas, & Descotes (1996) reviewed the potential consequences of immunotoxicity and pesticides. They reported that the organochlorine insecticides, although not exhibiting significant immunotoxicity in adult mice, were shown to affect the developing immune system from prenatal exposures. They noted, however, that this finding may not be applicable to the human population. The organophosphates were shown to decrease or suppress a wide range of immunological functions including reduced neutrophil chemotaxis, inhibition of monocyte antigen presentation, and a decrease in lymphocyte proliferation. The authors also reported a possible association between pesticide exposure and an increased incidence of some cancers. They indicated that there has been nearly a 60 percent increase in the incidence of non-Hodgkin's lymphoma primarily in rural areas, which suggests a possible role of environmental factors such as pesticides.

Populations at Risk

A population particularly at risk of exposure to pesticidal agents are migrant farm workers and their families (Hennings-Stout, 1996; Martin, Gordon, & Kupersmidt, 1995). Reidy, Bowler, Rauch, and Pedroza (1992) reported that migrant farm workers are the most frequent victims of both acute and chronic pesticide exposures. Migrant farm workers are typically poor and sometimes uneducated about the dangers of occupational exposure to pesticides (Vaughan, 1995). In a 1993 study by Vaughan, only 48% of migrant farm workers indicated that they had received health information about pesticide risks. However, the majority of the workers surveyed displayed significant worry for themselves and their families regarding the possible health effects of pesticide exposure.

A study by Ciesielski, Loomis, Mims, & Auer (1994) investigated acetylcholinesterase levels of North Carolina migrant workers exposed to organophosphate and carbamate pesticides. The mean acetylcholinesterase levels of the farmworkers were significantly lower than the levels of non-farmworkers. Forty-seven percent of the participants reported being sprayed directly with pesticides or working immediately adjacent to a spraying rig. Fifty-one percent of the workers in the Ciesielski et al. study reported an obvious chemical smell while working in the fields, and 58% reported that handwashing water was inconsistently available. The 1990 National Agriculture Workers Survey reported that 24% of migrant workers had no access to water for washing at work (Mines et al. as cited in Zahm & Blair, 1993). Reports of field conditions such as direct exposure to pesticides may not be uncommon. The Texas Department of Agriculture (TDA), in a 1984 report, reported that aerial applicators sometimes sprayed fields while farmworkers were working. The TDA report also described a 1980 survey of migrant workers by the National Association of Farmworker Organizations, indicating only 21 percent of workers surveyed were asked to leave the fields before aerial application of pesticides.

A study conducted by Reidy et al. (1992) found that migrant farm workers exposed to pesticides (combinations of Phosdrin - an OP compound, Lannate - a carbamate, and Maneb - an organomanganese fungicide) performed significantly worse on neuropsychological tests when compared to non-exposed farmworkers. Specifically, they scored worse on tests of motor speed, coordination, and visuospatial memory. In addition, the exposed workers reported significantly higher symptoms of anxiety and depression than the non-exposed workers. What may compound the problem of pesticide exposure is that some migrant farm workers may contribute their ailments to *susto*, which is a folk illness resulting in loss of appetite, listlessness, and poor motivation, and therefore not seek treatment or identify potential pesticide exposure as the cause of their ill health (Baer & Penzell, 1993). Migrant workers may also wish to avoid contact with government agencies (Rust, 1990) therefore limiting the initiative to seek medical care.

Adult migrant workers are not isolated in their exposure to potentially harmful pesticides. Children of migrant workers are also at risk for pesticide exposure (Munn, Keefe, & Savage, 1985). The number of migrants who travel without children has declined, which has lead to an increase in the number of children who are exposed to the migrant lifestyle (Siantz, 1994). Hispanic migrant workers make up the majority of migrant laborers, and they prefer traveling in family units (Siantz & Smith, 1994). Also, labor laws are less stringent for farmwork activities, which means that children as young as ten or twelve can join their parents in the fields to earn wages (Mobed, Gold, & Schenker, 1992; Wilk, 1993; Hennings-Stout, 1996). Delgado (as cited by Munn et al., 1985) reported that up to 58% of farm workers began working in the fields between the ages of 12 and 18 years old.

Children, through biology and behavior, may be more susceptible and vulnerable to exposure to pesticides than their migrant parents. Even young children, who may not work in the fields themselves, may be exposed to pesticides. Children who are too young to work in the fields may be brought to the fields by their parents due to low accessibility of affordable daycare in rural areas (Wilk, 1993). Other potential exposures to young children could occur through contact with their parents' pesticide-contaminated work clothes (Hartman, 1995; Rapp, 1996), being in close proximity to crops that have been sprayed with pesticides, or exposed to pesticides through pesticide drift. Pesticide drift, which occurs when highly volatile pesticides are sprayed in the fields, is unpreventable and the drift may float for miles into non-targeted residential areas (TDA, 1984). According to Matthews (as cited by Moses, 1989), only 10% to 15% of applied pesticides actually reach the target, and pesticides can drift as far as 50 miles from the target application site. Infants and children too young to work in the fields may accompany their parents and play near or in the field environment (Moses, 1989; Munn et al., 1985), or may be at risk simply living on or near a farm. Loewenherz, Fenske, Simcox, Bellamy, & Kalman, (1997) studied organophosphate biomarkers in children and found that children who lived closer to farmland had greater evidence of pesticide exposure than children who did not live near an orchard or crop. Wilk (1993) reported that many migrant labor camps are located in the fields, resulting in the potential for migrant's living quarters being sprayed during crop pesticide treatment. During harvest time, these quarters may be makeshift and temporary shelters next to the fields (Mobed, Gold, & Schenker, 1992) providing little protection from pesticide spray or drift.

Infants and young children are particularly vulnerable to toxic exposures because biological “windows of opportunity” exist for toxins to produce permanent damage to an organ system that may still be developing (Thomas, 1995). The developing central nervous system of a fetus or young child is much more vulnerable to injury from toxic substances than a mature nervous system, since the blood-brain barrier is not fully developed until the middle of the first year of life (Rodier, 1995). Another concern of pesticide exposure is the metabolic differences that exist between adults and children, which place the latter at greater risk (Lubin & Lewis, 1995). As noted by Bearer (1995), Gratz & Boulton (1993), and Little (1995) children have higher rates of oxygen consumption and metabolism, which increases the risk of air-borne toxic exposures. Children and infants have a greater percentage of water and fat and less lean body tissue than adults, which increases the absorption of toxins into the body since most neurotoxic substances are lipophilic (Bernstein, 1994). Children’s organs and systems are still developing (Bernstein, 1994), and exhibit higher rates of cell production, growth, and change (Carlson, 1998), which places them at greater risk of damage from toxic invaders. For example, a young child’s brain may be particularly susceptible to a chemical that inhibits mitosis (Weiss, 1985). In addition, children’s behaviors (e.g. oral exploratory behaviors, pica) place them at a greater risk to exposure than adults (Bearer, 1995). Children are more frequently on the ground and are closer to the ground, which is where many heavy pollutants are concentrated (Bearer, 1995). Children also consume more water and food than adults per percentage of body weight, which increases their risk of ingesting toxic residues when compared to adults (Mott, 1995).

In addition to the potentially higher rate and intensity of exposure to pesticides, children of migrant workers may experience other difficulties that are detrimental to their physical and emotional well-being. Children who work in agriculture with their parents may be exposed to hazardous farm machinery or dangerous crop-removal methods, poor field sanitation, and subjected to long, physically gruelling hours in the fields (Wilk, 1993; Harari, Forastiere, & Axelson, 1997). Larson, Doris & Alvarez (1990) reported that children of migrant workers were at a higher risk for abuse and neglect compared to the general population. Martin et al. (1994) reported that migrant children were exposed to extreme levels of violence, even higher than rates found in poverty-stricken, high crime urban areas. Kupersmidt and Martin (1997) found unusually high rates of anxiety disorders among children of migrant workers. Manaster, Chand and Safady (1992) reported that migrant children who came from large, poor, uneducated, and rural Mexican-American families were at higher risk for school failure. Hamilton (1984) reported that migrant youths had the lowest level of education and the highest rate of unemployment of any subgroup in the nation, and over 90% did not graduate from high school. Henggeler and Tavormina (1978) reported that migrant children showed clear patterns of vulnerabilities when compared to matched (age, sex, and SES) African-American children. Specifically, migrant children's overall self-concept was lower, WISC-R verbal scores were lower, and the migrant children reported greater perception of external (rather than internal) locus of control. The authors suggested that the migrant children's self-concept and perception of a more external locus of control may have unfortunately been an accurate reflection of the life they led (i.e. frequent moves, inconsistent schooling). Indeed, Shenkin (1974) reported that migrant workers who move within the central migrant stream (and are typically based in the Lower Rio Grande

Valley in Texas) make up the largest population of migrants and have the most interstate moves when compared to the California or Florida migrant streams.

Migrant workers and their families frequently live in substandard and overcrowded conditions (American Academy of Pediatrics, 1989; Cavenaugh, Lynch, Porteous, & Gordon, 1977; Mobed, Gold, & Schenker, 1992), sometimes with substandard sanitation (Schneider, 1986). These housing communities are often called “colonias”. In a report of the Border Low Income Housing Coalition (BLIHC, 1996) to the Governor of Texas, living conditions in colonias along the Texas border were as poor as those in many Third World countries. The report noted that of 214 farm workers surveyed in the El Paso area, 43% had no indoor toilets, 45% no tubs or showers, and 54% had no heating. With these living conditions in mind, children of migrant workers could have higher rates of chronic illness and hospitalization, as well as increased rates of iron deficiency and/or malnutrition, tuberculosis, dental diseases, upper respiratory infections, and parasitic disorders (American Academy of Pediatrics, 1989; Hennings-Stout, 1996; Martin et al., 1995; Ratcliffe, et al., 1989; Waldman, 1994). Indeed, a study by Slesinger, Christenson, & Cautley (1986) revealed that migrant children were at substantially greater risk of chronic health problems and early mortality compared to the general population. But as Cavenaugh, et al. (1977) and the American Academy of Pediatrics (1989) pointed out, migrant families frequent traveling, isolation, low income, and lack of health benefits may hinder their access to health care.

Pesticides will likely continue to be widely used for agricultural and non-commercial purposes. Children, who should not be considered little adults, are particularly vulnerable to neurotoxic substances such as pesticides because of metabolic and behavior differences that separate them from adults (Bearer, 1995). It is important to recognize the potential risks of pesticide exposure to migrant children, who may already be particularly at risk for physical and emotional problems due to extreme poverty and the migrant lifestyle, and determine the possible role pesticides may play in affecting their physical, behavioral, and psychological well-being. Children who are not from migrant families but live close to agricultural areas may also be at greater risk. With this in mind, the present study was designed to investigate differences between children at variable risk for pesticide exposure on a variety of behavioral, physical, and emotional symptoms. It is hypothesized that children who are at higher risk for pesticide exposure (based on positive responding on a series of risk-related questions), will report significantly higher physical, behavioral, and emotional symptoms than children who are at a lower risk.

Method

Subjects

This study was part of a larger investigation exploring thoughts and attitudes of rural adolescents. Two South Texas school districts agreed to participate in the study. Parents were notified, provided a description of the study, and were provided a form to request in writing that their child not participate in the study. Children whose parents signed and returned the non-participatory form were excluded. A total of 444 sixth-grade students completed information to be assigned a risk factor for the study, with 226 boys (50.9%) and 218 girls (49.1%). The average age was 11 1/2 years. The student's self-report of their ethnicity was as follows: 403 Hispanic or Mexican (90.9%), with three African-American participants (.6%), 23 Caucasian participants (5%), and 15 participants who identified themselves as mixed race or "other" (3%). 88.8% of the children reported they were born in the United States, and the home language reported by the participants is described below:

11.4% spoke only English in the home

16.1% spoke more English but some Spanish was spoken in the home

43.1% spoke English and Spanish equally in the home

21.6% spoke more Spanish than English

7.3% spoke only Spanish

Report of drug, alcohol, or inhalant use was minimal among the respondents: 92.4 % reported never using alcohol or drugs, while 4.5% reported some alcohol/drug use and 3.1% reported frequent drug or alcohol use. Despite the low incidence of reported drug or alcohol use, students who responded positively to "I use alcohol and drugs for nonmedical purposes" on the Youth Self-Report were omitted from the analysis to control for the effects of substance use on health and mood symptoms.

Materials

Youth Self-Report (Achenbach & Edelbrock, 1983; Achenbach, 1991). The Youth Self-Report (YSR) is a 112-item questionnaire for children ages 11-18. Subjects read a short statement, then circled the number (0 = Not true,1=Somewhat or sometimes true, or 2= Very true or often true) that most closely reflected their views for each item. The YSR has been widely used in social and behavior sciences (Song, Singh, & Singer, 1994), and has well established reliability and validity, particularly among the Internalizing and Externalizing composite items (Achenbach, 1991; McConaughy, 1993; Pumariega, Glover, Holzer, & Nguyen, 1998; Song, Singh, & Singer, 1994; Verhulst et al., 1993).

Student Opinion and Attitude Questionnaire: Six "yes" or "no" questions from the questionnaire regarding migratory farm work, residence near a farm or ranch, and detection of pesticides or farm chemicals were examined in conjunction with the Youth

Self-Report for the purpose of this study. The questions were as follows: 1) Do you and your family live in a colonia?; 2) Is your father and/or mother a migrant farm worker and do they leave the home to work in the fields, for example, picking strawberries?; 3) Do you travel with your family to do migrant farm work?; 4) When you travel with your family, do you help in the fields?; 5) If you are not a migrant farm worker, do you live on or near a farm or ranch?; 6) If you live on or near a farm or ranch can you see or smell farm chemicals or pesticides?

Procedure

Data was collected over a two-day period in November, 1997. Students were instructed not to put their names on the surveys, and the surveys were identified only by the student's ID number. The entire survey was read to the students by their classroom teachers, and the teachers assisted students when needed. If the child requested, or if the child was identified as an ESL (English as a Second Language) student, the survey was in Spanish and was read to the child in Spanish. Children who requested not to participate once the study was underway were permitted to discontinue their surveys.

The independent variable consisted of a three-category risk factor variable comprised from the individual responses to each of the six risk factor questions from the adolescent questionnaire. An overall "risk factor" score was comprised of a total score in response to the six questions ("Yes" score of 1, "No" score of 2). The "Low Risk" group were adolescents with risk factor scores of 11 or 12. The "Moderate Risk" group were adolescents with risk factor scores of 8, 9, or 10. The "High Risk" group included adolescents who respond "yes" to all (6 out of 6) or almost all (5 out of 6) of the pesticide-risk questions, resulting in scores of 6 or 7.

Standardized scoring of the Youth Self-Report (YSR) yielded raw scores and T scores for eight subscales and included: Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior. In addition, an Externalizing Behavior Composite, an Internalizing Behavior Composite, and a Total Composite were included in the analyses. These eleven scales comprised the dependent variables. Raw scores instead of T scores were used for analysis due to the normality of the distribution of the former, and as recommended for research purposes since T scores could reduce sensitivity of the observed differences (Achenbach, 1991; Drotar, Stein, & Perrin, 1995). T scores also resulted in a positively skewed distribution since the smallest possible T score was 50 (hence producing a large pool of subjects in that range).

Analysis of Variance (ANOVA) was used to determine the differences between the three risk factor groups and the various YSR scales. In addition, individual risk factor questions were examined in relation to the YSR subscales. Due to the ANOVA's sensitivity to outliers, the data were examined and subjects identified as outliers were removed from the analysis. The data were analyzed using the statistical package for the social sciences (SPSS) for the Macintosh. An alpha level of .05 was used for all statistical tests.

Results

Individual questions comprising the "Risk Factor" independent variable were first examined. Student responses were as follows: 43.4% of respondents reported they lived in a colonia; 16.5% reported that their parents were migrant farm workers; 16.9% reported that they traveled with their family during migrant farm work; 12.2% reported they helped in the fields; 14.5% reported they lived on a farm or ranch; 9.6% reported they saw or smelled farm chemicals or pesticides. In an attempt to validate the student's responses regarding their migrant status, school district data were utilized to compare migrant coding to the student's self-report. The district migrant coding was based on parent report of migrant status. From the school district database, 24.6% of the students were identified as coming from migrant families. The district data and student self-report were subjected to a cross-tabulation procedure to determine association between the responses using chi-square and Contingency Coefficient ($\underline{C}$) for categorical variables. The district migrant-coded data were strongly associated with the student's self-report about their own migrant status. 85.9% ($\underline{C}$ = .52878; $\underline{p}$ < .001) of the students who reported that their parents were migrant farm workers were also coded as migrant students from the school district records, as were 84.8% ($\underline{C}$ = .53145; $\underline{p}$ < .001) of the students who reported they traveled with their families to do migrant farm work.

Children were initially categorized into high, moderate, and low risk groups based on their responses to the six risk factor questions. However, due to the relatively low number of children classified as high risk (26 subjects), the high and moderate risk groups were combined, and a dichotomous independent variable (at-risk vs. low-risk) was used in an attempt to equalize the sample sizes among the groups. Table 1 summarizes the ANOVA between the two risk factor groups and the eleven subscales from the Youth Self-Report (see Appendix for complete table). Significant differences were observed between children considered at-risk of exposure to pesticides versus children who were at lower risk in the areas of anxious/depressed $\underline{F}$ (1, 408) = 5.9292, $\underline{p}$ < .05; attention problems $\underline{F}$ (1, 407) = 4.0363, $\underline{p}$ < .05; social problems $\underline{F}$ (1, 408) = 4.8499, $\underline{p}$ < .05; somatic complaints $\underline{F}$ (1, 400) = 8.0481, $\underline{p}$ < .01; thought problems $\underline{F}$ (1, 406) = 7.9992, $\underline{p}$ < .01; and withdrawal $\underline{F}$ (1, 408) = 6.2635, $\underline{p}$ < .01. In addition, at-risk children had significantly higher scores on the Total Problems composite $\underline{F}$ (1, 408) = 7.3945, $\underline{p}$ < .01 and the Internalizing Behaviors composite $\underline{F}$ (1, 406) = 8.3198, $\underline{p}$ < .01 compared to children at lower risk.

Table 1

Analysis of Variance (ANOVA) Means, Standard Deviations, and F Ratios Between Risk Factor Groups and Raw YSR scores

YSR Scale & Risk group	df	Mean	SD	F Ratio
Aggression	1,408			1.7220
At-risk		8.3	5.39	
low risk		7.59	5.11	
Anxious/ Depressed	1,408			5.9292*
At-risk		6.08	4.66	
low risk		4.98	4.25	
Attention Problems	1,407			4.0363*
At-risk		4.56	2.90	
low risk		3.99	2.67	
Delinquent	1,408			2.9715
At-risk		3.07	2.56	
low risk		2.65	2.23	
Externalizing Composite	1,408			2.5508
At-risk		11.37	7.25	
low risk		10.25	6.58	
Internalizing Composite	1,406			8.3198**
At-risk		13.25	8.14	
low risk		10.94	7.46	
Social Problems	1,408			4.8499*
At-risk		3.28	2.26	
low risk		2.78	2.14	

(table continues)

Somatic Complaints	1,400			8.0481**
At-risk		4.16	3.09	
low risk		3.29	2.84	
Thought Problems	1,406			7.9992**
At-risk		2.67	2.12	
low risk		2.07	1.97	
Total Problems Composite	1,408			7.3945**
At-risk		41.02	20.30	
low risk		35.47	19.44	
Withdrawal	1,408			6.2635**
At-risk		3.53	2.22	
low risk		2.96	2.16	

*$p < .05$. **$p < .01$

In order to investigate how the individual risk factor questions may have contributed to overall significance on the various YSR subscales, the six individual questions (with students responding either yes or no to each question) comprising the Risk factor variable were subjected to univariate ANOVA with the YSR subscales as the dependent variables. Table 2 summarizes the results.

As noted in Table 2, significant differences were obtained between the groups on several questions. In a comparison of children who reported they lived in a colonia vs. students who did not (M1), the students who lived in a colonia had significantly higher scores in the areas of aggression, attention problems, delinquency, withdrawal, externalizing and internalizing behavior, and total behavior problems.

Table 2

ANOVA F Ratios for Individual Risk Factor Questions Compared to YSR subscales

Do you live in a colonia? (M1)
Is your father/mother a migrant farm worker? (M2)
Do you travel with your family to work in the fields? (M3)
If you live on a farm or ranch, do you see or smell farm chemicals or pesticides? (M6)
When you travel with your family do you help in the fields? (M8)
If not a migrant worker, do you live on or near a farm or ranch? (M9)
YSR Subscale:

	M1 (n=413)	M2 (n=415)	M3 (n=413)
Aggression	6.9137**	1.8235	2.4677
Anxious/depressed	3.2452	2.4913	1.578
Attention Problems	5.1791*	.0025	.3427
Delinquent	14.1165**	2.4583	4.4505*
Externalizing Composite	10.894**	2.472	3.7211
Internalizing Composite	4.921*	7.2196	6.1422*
Social Problems	.9216	1.4423	.6718
Somatic Complaints	2.0798	10.756**	9.1603**
Thought Problems	14.3392	2.320	4.2548*
Total Composite	9.2707**	4.4482*	4.8312*
Withdrawal	8.942**	6.8027**	10.1741**
	M6 (n=401)	**M8 (n=70)**	**M9 (n=319)**
Aggression	.9147	.2417	.4084
Anxious/depressed	.0894	.8877	1.0178
Attention Problems	.3260	3.4449	3.3020
Delinquent	3.7889	.9848	1.2923
Externalizing Composite	1.9938	.0013	.7841
Internalizing Composite	.0645	2.2179	.2.9114
Social Problems	.7918	1.2931	.0514
Somatic Complaints	1.5802	1.9131	7.7701**
Thought Problems	5.9693*	.0365	3.2566
Total Composite	1.2725	.9639	2.8364
Withdrawal	.0185	1.3297	.0379

*p < .05. **p < .01

Students who reported they were children of migrant farm workers (M2) had significantly higher somatic complaints, withdrawal, and total behavior problems than children who reported they were not in a migrant family. Children who reportedly traveled with their families to do migrant work (M3) exhibited significantly higher scores in delinquency, somatic complaints, thought problems, withdrawal, internalizing behaviors, and total behavior problems. Children who reported smelling or seeing farm chemicals or pesticides (M6) exhibited significantly higher scores in the areas of thought problems. Due to the slight ambiguity of Migrant Question number 4 “When you travel with your family, do you help in the fields?”, an additional variable (M8) was added to delineate children who reported that they did or did not help in the fields (while traveling with their families) vs. children who would have reported “no” to the question because they did not travel with migrant-working families at all. No significant differences were observed between children who did or who did not work in the fields when they traveled with their migrant families. Another question that was slightly ambiguous (If you are not a migrant worker, do you live on or near a farm?) was recoded to exclude children who responded positively to this question as well as affirming they were from migrant families to isolate only children who did or did not live on or near a farm (without also being a migrant child). Nonmigrant children who reported that they lived on or near a farm or ranch (M9) reported significantly higher scores in the area of somatic complaints.

Lastly, severity of problems based on computed T scores of the YSR subscales was investigated to determine if the degree of risk (i.e. at-risk or low/no risk) influenced clinically significant endorsement of physical, behavioral, or emotional problems. Each risk factor question was also examined to identify how individual risk areas (i.e. living in a colonia, working in the fields, etc.) influenced severity on the scales. Individual 2 x 2 tables were constructed to determine frequency and percentages based on a dichotomous variable for YSR severity: a T scores of 67 became the cutoff criterion. T scores 67 and above are considered to be in the clinical range and T scores below 67 are considered to be nonsignificant according to the scoring system utilized for the Youth Self-Report (Achenbach, 1991). The dichotomous variables for comparison were either "yes" or "no" for the six migrant questions, or at-risk/low risk for the overall risk factor. Odds ratios were calculated and ratios above 1.5 were included. Tables 3 and 4 summarize the data.

Table 3

Odds Ratios and Percentages for At-risk Students Reaching Significance on YSR Scales

Variable:	YSR Scale:	Odds Ratio	Percentage[a]	Percentage[b]
At-risk	Anxious/Depressed	2.13	7.1%	4.8%
	Attention Problems	5.46*	5.7%	2.7%
	Delinquency	1.6	8.4%	6.4%
	Internalizing Behavior	3*	8.8%	5.1%
	Somatic Complaints	1.62	18.3%	14.3%
	Thought Problems	1.94	6.0%	4.3%
	Total Behavior Problems	1.93	5.8%	4.1%

Note. Percentage[a] = percentage of at-risk children scoring in clinically significant range.

Percentage[b] = percentage of all children scoring in the clinically significant range.

* 95% CI >1

As noted in Table 3, children who were at-risk for exposure to pesticides were significantly more likely than children at lower risk to score in the clinical range (T scores above 67) on the Attention Problems and Internalizing Behavior YSR subscales.

Table 4

Odds Ratios and Percentages for Each of the Six Risk Questions Reaching Clinical Significance on YSR Scales

Variable:	YSR Scale:	Odds Ratio	Percentage[a]	Percentage[b]
Lives in a colonia:				
	Anxious/Depressed	1.6	6.2%	5.0%
	Attention Problems	2.61	4.5%	3.0%
	Delinquency	4.59*	11.0%	6.4%
	Thought problems	2.09	6.2%	4.5%
	Total Behavior problems	1.8	5.7%	4.3%
Parents are Migrant:				
	Aggression	1.74	8.5%	5.6%
	Anxious/Depressed	1.74	7%	4.7%
	Internalizing com.	2.99*	10.1%	4.8%
	Somatic Complaints	1.67	20.0%	14.3%
	Thought problems	2.48	8.5%	4.5%
	Total Behavior Problems	1.63	5.8%	4.0%
Travel with Migrant Family:	Aggression	1.68	8.3%	5.7%
	Internalizing com.	2.05	8.5%	5.1%
	Somatic complaints	1.87	21.7%	14.5%
	Thought problems	2.52	7.8%	4.2%
Live on farm/ranch:	Attention problems	10.43*	10.6%	2.6%
	Somatic complaints	1.82	20.0%	13.4%
Smell chemicals or pesticides:	Attention problems	4.81*	7.7%	2.3%
	Somatic complaints	1.61	20.0%	14.1%

Note. Percentage[a] = percentage of at-risk children scoring in clinically significant range.

Percentage[b] = percentage of all children scoring in the clinically significant range.

*95% CI >1

Individual risk factor questions also resulted in significant differences. As noted in Table 4, children who lived in a colonia were over 4.5 times more likely to score in the clinically significant range on the Delinquency subscale. Children whose parents were migrant farm workers were almost three times more likely to score in the clinical range on the Internalizing subscale, although traveling with their migrant families did not influence significantly higher subscale scores. Children who lived on a farm or a ranch were ten times more likely to exhibit clinically significant attention problems. Lastly, children who reported that they smelled chemicals or pesticides were over four times more likely report clinically significant attention problems compared to children who did not live on or near farms. Comparison of the percentages of at-risk children to percentages from the entire sample of children falling in the clinically significant range reflected that at-risk children were more likely to exhibit a variety of significant YSR symptoms.

Discussion

Results of this study support the hypothesis that children who may be at greater risk of pesticide exposure are more likely to report significantly higher symptoms in various behavioral or emotional arenas on the Youth Self-Report than children who are not at risk or are at a substantially lower risk of pesticide exposure. Children who were at greater risk for exposure to pesticides scored significantly higher in the areas of anxiety/depression, attention problems, social problems, somatic complaints, thought problems, and withdrawal than children in the low risk category. Broadband scores such as the Internalizing Behavior composite and Total Behavior Problems composite were also significantly higher for children in the at-risk group.

In addition to overall risk factor, a review of individual risk questions suggested that most questions resulted in significant findings between the dichotomous subject responses (either affirming or denying each individual question) but to varying degrees. The question that had the least impact on overall response pattern on the Youth Self-Report was question number 4: “When you travel with your family, do you help in the fields?”. Only the somatic complaints subscale was significantly higher by responding “yes” to this question, and the “no” respondents may have included children who did come from migrant families anyway. When the data were manipulated to only include children who were from migrant families, there was no significant difference between those who reported they helped in the fields and those who did not help in the fields. It is postulated that significant differences may not have been achieved since children who do not work with their migrant families in the fields may still be at risk if they travel with their families and are nearby. As noted by Moses (1989) children of migrant workers who are not workers themselves may still accompany their parents to work, perhaps placing them at similar risk for exposure.

The other two questions related to migrant farm work: question 2 “Is your mother/father a migrant farm worker?” and question 3 “Do you travel with your family to work in the fields?” each resulted in significantly higher scores in somatic complaints, withdrawal, and total behavior problems. Anxious and/or depressive symptomology was not significantly different between migrant and nonmigrant children, which contrasts

Kupersmidt and Martin's (1997) findings of significantly higher anxiety disorders among children of migrant workers.

For the question regarding living in a colonia, the externalizing and internalizing behavior composites, aggression, attention problems, withdrawal, and total behavior problems were significantly higher for children who lived in a colonia. Since a large proportion (68% in this study) of migrant families live in colonias (TDA, 1984), one might expect higher rates of physical illness and somatic complaints due to substandard living conditions noted in some migrant communities (Hennings-Stout, 1996; Martin et al., 1995; Waldman, 1994). However, the Somatic Complaints subscale was not significantly different for children categorized as living or not living in a colonia. Based on this information, it is hypothesized that the somatic complaints reported by migrant children were not simply due to poorer living conditions, hygiene, or nutrition deficiencies sometimes observed in colonias. Instead, another factor related to being from a migrant family impacted the results. Potential factors resulting in somatic problems in migrant children could include exposure to violence (Martin et al. 1994), school failure (Manaster, Chand, and Safady, 1992), frequent traveling resulting in inconsistent schooling (Guillette, et al., 1998), or poverty (Hennings-Stout, 1996). Another potential factor, however, might be pesticide exposure. Children who were not migrant farm workers but who lived on or near a farm or ranch also reported significantly higher symptoms on the Somatic Complaints subscale. This suggested that migrant children and children living on farms were experiencing significantly higher somatic complaints than nonmigrant children or children who did not live on or near a farm. Contrastly, children who reported that they lived in a colonia were more likely to report significantly higher symptoms in externalizing behaviors such as aggression and delinquency but not significantly higher somatic complaints.

The global Risk Factor categories were derived to obtain information from a variety of children who may be at greater risk for pesticide exposures. However, it is important to discuss these results in relation to individual children. Any environmental, physical, or emotional stressor should be considered within the framework of a child's personal susceptibility. Peer and familial relationships, financial stability, physical environment, health, genetic susceptibility, etc. all will impact an individual child's ability to cope with the daily stressors encountered as they mature. Some of the children in this study experience greater poverty, lower quality housing, and reduced health care access, frequent traveling, and inconsistent schooling, which may have contributed to the current findings. Some of these factors may have actually compounded children's exposure to chemicals (Landrigan, et al., 1998), and may also have negatively impacted the child's psychological and physiological ability to recover from and/or cope with exposure to various environmental stressors (including pesticides). It will be essential to assess each child's individual susceptibility; not only through geographic boundaries or their parent's employment, but also through the daily stressors (poverty, poor nutrition, stress) they may experience on a regular basis which places them at greater risk.

Implications for Future Research

Despite the current results, it is difficult to ascertain how much exposure to pesticides influenced the differences between the at-risk and the low risk groups. Due to the general nature of children's self-report, and in order to more strongly interpret and confirm data, it will be important to gain information from other sources in an attempt to identify risk factors and significant effects related to risk. Parent reports, teacher reports, school records, and medical information can all be utilized to confirm the children's self-report of their physical symptoms and behaviors. To be consistent with toxicological research, investigation of actual pesticide exposure will be crucial in order to link children's symptoms to levels of exposure. Future studies should follow the environmental risk paradigm to more accurately determine actual risk to these children. Objective measurement of pesticide residues in children's environment in addition to biological measurement of pesticide contact will be most beneficial in confirming exposure. Proximity to potential exposure sites (geographical risk) will help provide epidemiological data for population risk. Degree of symptoms should be consistent with degree of exposure, and the data should be replicable.

Confirmation of potential pesticide exposure can only be obtained from biological markers of absorption, inhalation, or ingestion (Weaver, Buckley, & Groopman, 1998). As noted above, objective evaluation of children's exposure to pesticides appears warranted, such as attempting to evaluate pesticide biomarkers through blood samples to determine acetylcholinesterase levels. Biomarkers would reflect exposure from all routes and sources and may be useful for detecting small but potentially chronic exposures from various sources (Tinoco-Ojanguren & Halperin, 1998; Weaver, Buckley, & Groopman, 1998). As neuropsychological sequelae is documented in adults with occupational pesticide exposures (Reidy, et al., 1992), neuropsychological testing would help to determine the effect of pesticide exposure on developing children. For migrant children, assessment of biomarkers and neuropsychological testing before migrant children begin traveling with their families (beginning the migrant stream), and testing again after returning from the migrant picking season would help identify changes that occurred as a result of pesticide exposure.

All the students in this sample were from a small, rural South Texas community. Comparison with urban children would be beneficial to determine what differences are evident, as well as potential similarities. Urban children may be exposed to multiple toxicants such as lead and benzene, which are frequently found to be higher in cities than in rural areas (Weaver, Buckley, & Groopman, 1998). If rural children have a greater chance of exposure to different toxins such as pesticides, assessing rural and urban children's behavior, cognitive functioning, and physical health in relation to potentially different environmental exposures should be assessed and documented.

Implications for Schools

As noted above, schools may be the first line of defense in identifying children who are at higher risk to pesticide exposure. Access to medical care may be limited, through poor geographical access, suspicion/wariness of the medical profession, or issues of cost. Therefore, schools may be the only potential source to identify children not only exposed to pesticides or other chemicals, but who are experiencing other difficulties such as domestic violence, poverty, poor nutrition, and poor health. Although the current results suggest a generally low pattern of children scoring in the clinically significant range on the Youth Self Report among this sample, it will be important for school psychologists, teachers, counselors, and administrators to keep in mind the potential risk factors identified in this study that may negatively impact a child's behavior, emotions, or health. These results may be particularly beneficial to states and school districts who are less familiar with migrant children attending their schools for short periods of time throughout the migrant season. This information should provide school districts with a better understanding of the stressors and challenges facing children at greater risk of pesticide exposure and the resulting symptoms they may exhibit. This information will hopefully aid them in providing support and guidance to the children they serve.

APPENDIX

TABLE 5

Table 5

Complete Analysis of Variance for Risk Groups and YSR Subscales

Aggression

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	46.8750	46.8750	1.7220
Within Groups	408	11106.4445	27.2217	
Total	409	11153.3195		

Anxious/Depressed

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	115.1647	115.1647	5.9292
Within Groups	408	7924.7401	19.4234	
Total	409	8039.9049		

Attention Problems

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	30.7396	30.7396	4.0363
Within Groups	407	3099.6124	7.6158	
Total	408	3130.3521		

(table continues)

Delinquency

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	16.4738	16.4738	2.9715
Within Groups	408	2261.9165	5.5439	
Total	409	2278.3902		

Externalizing Composite

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	118.9261	118.9261	2.5508
Within Groups	408	19022.1983	46.6230	
Total	409	19141.1244		

Internalizing Composite

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	494.9095	494.9095	8.3198
Within Groups	406	24151.0880	59.4854	
Total	407	24645.9975		

(table continues)

Social Problems

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	23.2291	23.2291	4.8499
Within Groups	408	1954.1465	4.7896	
Total	409	1977.3756		

Somatic Complaints

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	69.1248	69.1248	8.0481
Within Groups	400	3435.5917	8.5890	
Total	401	3504.7164		

Thought Problems

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	32.8833	32.8833	7.9992
Within Groups	406	1668.9893	4.1108	
Total	407	1701.8725		

(table continues)

Total Behavior Problems Composite

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	2885.0696	2885.0696	7.3945
Within Groups	408	159186.0255	390.1618	
Total	409	162071.0951		

Withdrawal

Source	D.F.	Sum of Squares	Mean Squares	F Ratio
Between Groups	1	29.9173	29.9173	6.2635
Within Groups	408	1948.8047	4.7765	
Total	409	1978.7220		

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